VENTILATIVE COOLING IN THE DANISH REGULATIONS

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BACKGROUND

THE DEVELOPMENT TOWARDS ”NEAR ZERO ENERGY BUILDINGS” HAS RESULTED IN AN INCREASED NEED FOR COOLING – NOT ONLY IN SUMMER BUT MOST OF THE YEAR!

TOO HIGH INDOOR TEMPERATURES ARE THE MOST REPORTED PROBLEM IN POST OCCUPANCY STUDIES OF THE INDOOR ENVIRONMENT IN LOW ENERGY BUILDINGS IN DENMARK – EVEN IN THE HEATING SEASON!

THE MAIN FOCUS IN THE DESIGN PROCES HAS BEEN TO REDUCE THE NEED FOR HEATING (INSULATION, AIR TIGHTNESS), BUT THERE IS A STRONG NEED TO ADRESS COOLING AS WELL.

BY USING THE COOLING POTENTIAL OF OUTDOOR AIR ATTRACTIVE AND ENERGY EFFICIENT SOLUTIONS CAN BE DEVELOPED

WE HAVE EXPERIENCED AN OVERHEATING PROBLEM

OVERHEATING IS A ”NEW AND INCREASING PROBLEM” FOR LOW ENERGY RESIDENCES

- Is underestimated and are not given enough focus in the design process

TOO SIMPLIFIED DESIGN METHODS ARE USED

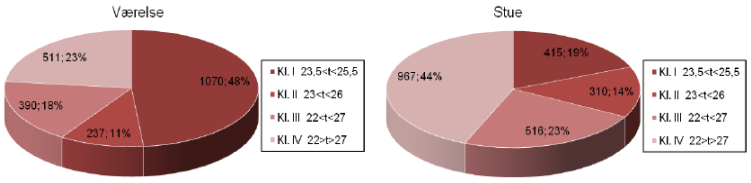
- Averaging heat loads in time and space
- Uncertain correlation between cooling need and overheating risk

NO (VERY FEW) AVAILABLE STANDARD SOLUTIONS – ESPECIALLY FOR RESIDENCES

- Users have no (very limited) experience in handling overheating
- “One-of-a-kind” solutions are often not ”adapted to practical use”

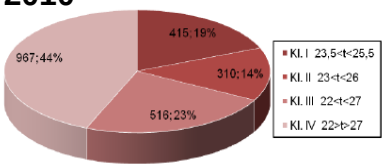
OVERHEATING

2010

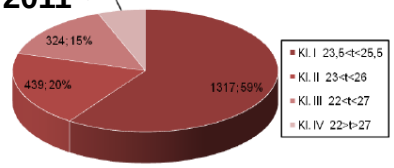


KOMFORTHUSENE
– IMPACT OF INTERNAL SOLAR SHADING

2010 Stue



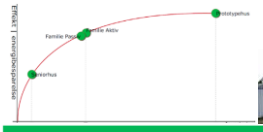
2011 Stue



ENERGIPARCEL, TILST, DENMARK

Realdania Byg
UDVIKLER OG BEVARER

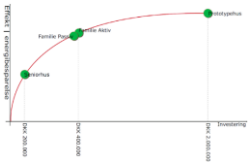
ENERGIPARCEL – RENOVATION EXAMPLES



	Mejløvænget 9 Seniorhuset	Langøvænget 1 Familiehus - Passiv	Farøvænget 4 Familiehus - Aktiv	Langøvænget 8 Prototypehuset
Tætning og isolering af facader				●
Solceller			●	●
Ovenlys			●	●
Isolering fundament				●
Isolering mod terræn, overalt		●		●
Isolering mod terræn, delvist		●	●	●
Superlavenergi-vinduer, nordfacade				●
Superlavenergi-vinduer, østfacade			●	●
Superlavenergi-vinduer, vestfacade	●	●		●
Superlavenergi-vinduer, sydfacade	●		●	●
Isolering vinduesfalse	●	●	●	●
Automatisk styring, varmeanlæg	●	●	●	●
Isolering rem	●	●	●	●
Isolering loft/tag	●	●	●	●

Source: Tine Steen Larsen, Jørgen Søndermark

ENERGIPARCEL – THERMAL COMFORT 2010



Temperatur Living Room	Mejløvænget 9	Langøvænget 1	Farøvænget 4	Langøvænget 8
> 26 C (hours)	181	578	180	99
> 27 C (hours)	54	370	60	28

Source: Tine Steen Larsen, Jørgen Søndermark

VENTILATIVE COOLING IS A SOLUTION

VENTILATIVE COOLING CAN BE AN ATTRACTIVE AND ENERGY EFFICIENT PASSIVE SOLUTION TO AVOID OVERHEATING.

- Ventilation is already present in most buildings through mechanical and/or natural systems using opening of windows
- Ventilative cooling can both remove excess heat gains as well as increase air velocities and thereby widen the thermal comfort range.
- The possibilities of utilizing the free cooling potential of low temperature outdoor air increases considerably as cooling becomes a need not only in the summer period.

VENTILATIVE COOLING IN A DANISH CONTEXT

APPLICATION OF VENTILATIVE COOLING FOR RESIDENTIAL BUILDINGS IS AT A LOW LEVEL

- It is considered difficult to evaluate
- Few technical solutions available – mainly manual window opening only very few automated

VENTILATIVE COOLING IS A STANDARD SOLUTION IN OFFICES WITH MECHANICAL VENTILATION

- Designed for IAQ criteria
- Limited benefit due to fan energy use

VENTILATIVE COOLING BY NATURAL/HYBRID VENTILATION IS KNOWN

- But only used in a few cases in offices

VENTILATIVE COOLING IN DANISH BUILDING REGULATIONS

DANISH BUILDING REGULATION ALLOWS IN GENERAL TERMS TO TAKE INTO ACCOUNT THE EFFECT OF VENTILATIVE COOLING

- But does not give any guidelines or recommendations.

FOR THERMAL COMFORT BUILDING REGULATIONS REFER TO ISO 7730 AND DS 447

- But states that air velocities above 0,15 m/s is acceptable if indoor temperature exceeds 24oC
- Indoor temperature level must not exceed 27C for more than 100 hours/year and 28C for more than 25 hours/year

A SIMPLIFIED METHOD IS AVAILABLE TO DOCUMENT COMPLIANCE

- But as it is based on a mean-monthly approach reliability could be better

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VENTILATIVE COOLING IN DANISH EBPD COMPLIANCE TOOL – BE10

THE DANISH COMPLIANCE TOOL *BE10* IS BASED ON A SIMPLIFIED MEAN-MONTHLY CALCULATION

- Must be used to document compliance with Danish building regulation
- Prediction of cooling needs and overheating risk not very accurate

VENTILATIVE COOLING IS POSSIBLE TO INCLUDE IN THE BUILDING ENERGY PERFORMANCE CALCULATION, ALSO FOR NATURAL VENTILATION – IF YOU ARE VERY CLEVER

THE TOOL ALLOWS YOU TO INPUT VENTILATION RATE VALUE FOR VENTILATIVE COOLING SEPARATED IN DAY AND NIGHT VALUES

- but does not assist you in determining the value
- Simple to use for mechanical systems, but difficult for natural ventilation.

THE TOOL DOES ESTIMATE THE COOLING NEED (AVERAGE FOR WHOLE BUILDING)

- It is possible to calculate the risk of overheating for a critical room
- It does not take into account effects of elevated air velocity

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VENTILATIVE COOLING IN DANISH VENTILATION STANDARD – DS447

THE DANISH STANDARD DS 447 SPECIFIES REQUIREMENTS FOR MECHANICAL, NATURAL AND HYBRID VENTILATION SYSTEMS – AND ALSO INCLUDES VENTILATIVE COOLING EXPRESSED AS

- Free cooling,
- Night cooling,
- Passive cooling,
- Cooling by means of natural ventilation.
- Effects of elevated air velocities (informative annex)

HOWEVER NO GUIDELINES ARE GIVEN:

- for system design
- calculation of cooling performance
- or how elevated velocities can be achieved and documented

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STATUS OF VENTILATIVE COOLING IN DANISH REGULATORY CONTEXT

BUILDING REGULATIONS AND STANDARDS SUPPORT THE USE OF VENTILATIVE COOLING, MAINLY IN WORDS BUT WITHOUT MUCH GUIDANCE

THE DANISH EPBD COMPLIANCE TOOL DOES NOT SUPPORT A FAIR EVALUATION OF VENTILATIVE COOLING AS PART OF THE CALCULATION PROCEDURE.

STATUS

(NATURAL) VENTILATIVE COOLING IS CONSIDERED SOMEWHAT DIFFICULT TO WORK WITH AS DESIGNER OR ENGINEER - TOO LITTLE GUIDANCE AND TOO LARGE RESPONSIBILITY.

THEREFORE (NATURAL) VENTILATIVE COOLING IS NOT WIDELY INCLUDED BY BUILDING DESIGNERS.

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FUTURE OF VENTILATIVE COOLING IN DANISH REGULATORY CONTEXT

LOOKS PROMISING

- Increased legislative focus on summer comfort

FUTURE NEEDS

- Simplified methods for calculating air change rates during nighttime and daytime in buildings with increased ventilation rates (with the purpose of cooling the building).
- Simplified methods for determining the cooling effect of increased ventilation rates.
- Control strategies for ventilative cooling based on relevant thermal comfort criteria.

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